Name: ______________________________ Date: ______________

Polynomial Operations SOLUTION (version 124)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -10x^5 - 8x^3 + 6x^2 + 9x + 2$$

$$q(x) = 6x^5 - 10x^4 + 2x^3 + 8x - 9$$

Express the difference $q(x) - p(x)$ in standard form.

Get "unsimplified" forms. Then find $q(x) - p(x)$ with addition/subtraction.

$$p(x) = (-10)x^5 + (0)x^4 + (-8)x^3 + (6)x^2 + (9)x^1 + (2)x^0$$
$$q(x) = (6)x^5 + (-10)x^4 + (2)x^3 + (0)x^2 + (8)x^1 + (-9)x^0$$
$$q(x) - p(x) = (16)x^5 + (-10)x^4 + (10)x^3 + (-6)x^2 + (-1)x^1 + (-11)x^0$$
$$q(x) - p(x) = 16x^5 - 10x^4 + 10x^3 - 6x^2 - x - 11$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 8x^2 - 5x + 9$$

$$b(x) = 7x + 4$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$8x^2$	$-5x$	9
$7x$	$56x^3$	$-35x^2$	$63x$
4	$32x^2$	$-20x$	36

$$a(x) \cdot b(x) = 56x^3 - 35x^2 + 32x^2 + 63x - 20x + 36$$

Combine like terms.

$$a(x) \cdot b(x) = 56x^3 - 3x^2 + 43x + 36$$

3. Express $(x + 1)^5$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

Polynomial Operations SOLUTION (version 124)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -3x^3 + 19x^2 - 2x - 26 \\ g(x) &= x - 6 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-6}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{c|cccc} & -3 & 19 & -2 & -26 \\ 6 & & -18 & 6 & 24 \\ \hline & -3 & 1 & 4 & -2 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = -3x^2 + x + 4 + \frac{-2}{x-6}$$

In other words, $h(x) = -3x^2 + x + 4$ and the remainder is $R = -2$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -3x^3 + 19x^2 - 2x - 26$. Evaluate $f(6)$.

You could do this the hard way.

$$\begin{aligned} f(6) &= (-3)\cdot(6)^3 \ + \ (19)\cdot(6)^2 \ + \ (-2)\cdot(6) \ + \ (-26) \\ &= (-3)\cdot(216) \ + \ (19)\cdot(36) \ + \ (-2)\cdot(6) \ + \ (-26) \\ &= (-648) \ + \ (684) \ + \ (-12) \ + \ (-26) \\ &= -2 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(6)$ equals the remainder when $f(x)$ is divided by $x - 6$. Thus, $f(6) = -2$.